`https://engineering.purdue.edu/~chihw/24ECE301S/24ECE301S.html`

Question 75: [Basic] For a continuous time $x(t) = 2^{-|t|}$, find out the Fourier transformation of $x(t)$. (Hint: Example 4.2)

Question 76: [Basic] For a continuous time $x(t) = \mathcal{U}(t+2) - \mathcal{U}(t-2)$, find out the Fourier transformation of $x(t)$. (Hint: Example 4.4)

Question 77: [Basic] For a continuous time $x(t) = \cos(2\pi t) + \sin(4t)$, find out the Fourier transformation of $x(t)$.

Question 78: [Basic] For a continuous time signal with $X(j\omega) = \mathcal{U}(\omega + 3) - \mathcal{U}(\omega - 3)$, find out the inverse Fourier transformation of $X(j\omega)$.

Question 79: [Basic] Textbook, p. 334, Problem 4.3.

4.3. Determine the Fourier transform of each of the following periodic signals:
(a) $\sin(2\pi t + \frac{\pi}{4})$ (b) $1 + \cos(6\pi t + \frac{\pi}{8})$

Question 80: [Basic] Textbook, p. 334, Problem 4.4.

4.4. Use the Fourier transform synthesis equation (4.8) to determine the inverse Fourier transforms of:
(a) $X_1(j\omega) = 2\pi \, \delta(\omega) + \pi \, \delta(\omega - 4\pi) + \pi \, \delta(\omega + 4\pi)$

Question 81: [Basic] Textbook, p. 336, Problem 4.10.

4.10. (a) Use Tables 4.1 and 4.2 to help determine the Fourier transform of the following signal:

$$x(t) = t \left(\frac{\sin t}{\pi t} \right)^2$$

(b) Use Parseval's relation and the result of the previous part to determine the numerical value of

$$A = \int_{-\infty}^{+\infty} t^2 \left(\frac{\sin t}{\pi t} \right)^4 dt$$

Question 82: [Basic] Textbook, p. 336, Problem 4.12(a).

4.12. Consider the Fourier transform pair

$$e^{-|t|} \overset{\mathcal{F}}{\longleftrightarrow} \frac{2}{1 + \omega^2}.$$

(a) Use the appropriate Fourier transform properties to find the Fourier transform of $te^{-|t|}$.

Question 83: [Basic] Textbook, p. 336, Problem 4.13.

4.13. Let $x(t)$ be a signal whose Fourier transform is

$$X(j\omega) = \delta(\omega) + \delta(\omega - \pi) + \delta(\omega - 5),$$

and let

$$h(t) = u(t) - u(t - 2).$$

(a) Is $x(t)$ periodic?
(b) Is $x(t) * h(t)$ periodic?
(c) Can the convolution of two aperiodic signals be periodic?